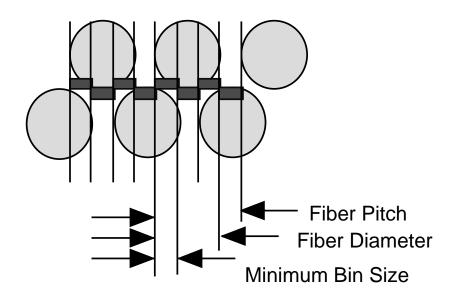
- The D0 Central Fiber Tracker
 - Geometry
 - Trigger
- Occupancy
- Trigger Rates
- What to Change

Tracker Geometry

Fibers Arranged in Doublet Layers

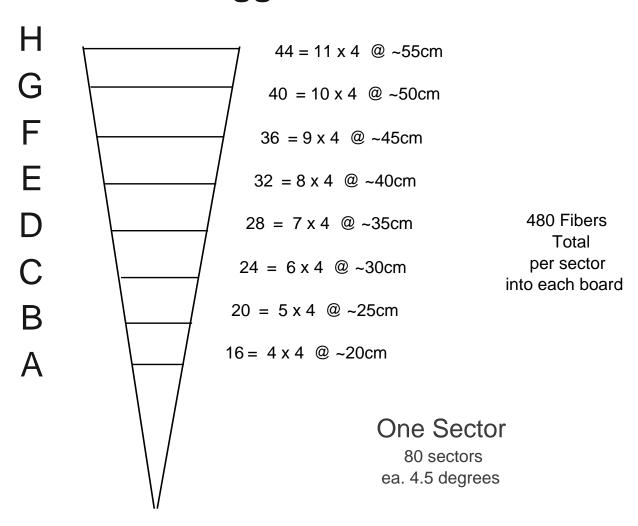
- 8 Doublet Layers are parallel to the beam Axial Doublets
- 8 Doublet Layers are at stereo angles to beam U & V Stereo

DL { doublet layer }



- **D0** β Fiber Pitch ~ 1 mm
 - Fine Binning = Sum of 4 Minimum bins

Baseline Detector Fiber Arrangements for Trigger



Fakes

High Occupancy from Noise and Low Pt tracks Causes Fakes

• Fakes vs. Road Width

A wide road allows more fakes

A narrow road requires more trigger resources

Fakes vs. Efficiency

Any isolation veto in trigger lowers efficiency as occupancy goes up

Dropping low acceptance roads cuts into efficiency

Occupancy

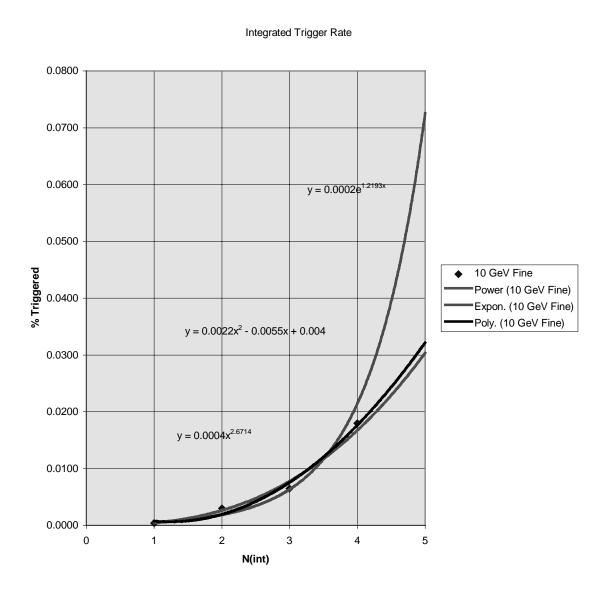
Luminosity	crossings	<int>/cross</int>	<occ>/cross</occ>	
_			Inner Layer	Outer Layer
8.00E+31	6	13.12	52.50%	19.69%
2.00E+32	6	32.81	100.00%	49.22%
1.00E+33	6	164.06	100.00%	100.00%
2.00E+33	6	328.12	100.00%	100.00%
8.00E+31	36	2.19	8.75%	3.28%
2.00E+32	36	5.47	21.87%	5.47%
1.00E+33	36	27.34	100.00%	27.34%
2.00E+33	36	54.69	100.00%	54.69%
8.00E+31	108	0.73	2.92%	1.09%
2.00E+32	108	1.82	7.29%	1.82%
1.00E+33	108	9.11	36.46%	9.11%
2.00E+33	108	18.23	72.92%	18.23%
8.00E+31	252	0.31	1.25%	0.47%
2.00E+32	252	0.78	3.12%	0.78%
1.00E+33	252	3.91	15.62%	3.91%
2.00E+33	252	7.81	31.25%	7.81%

Geant MC for minimum bias events generated using di-jet s.

4% Occupancy / Interaction for Inner layer

1.5% Occupancy / Interaction for Outer layer

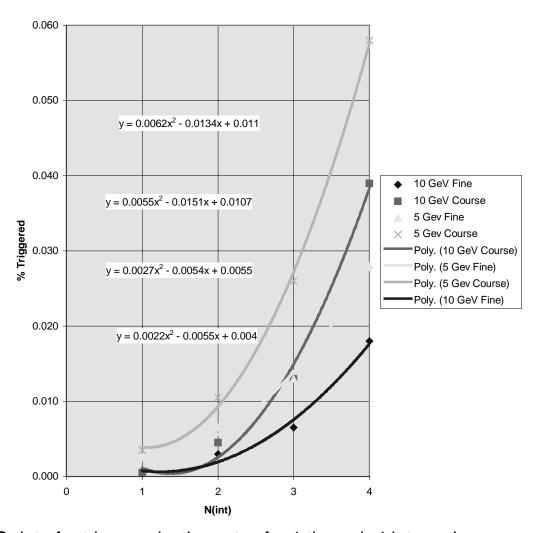
Trigger Rates



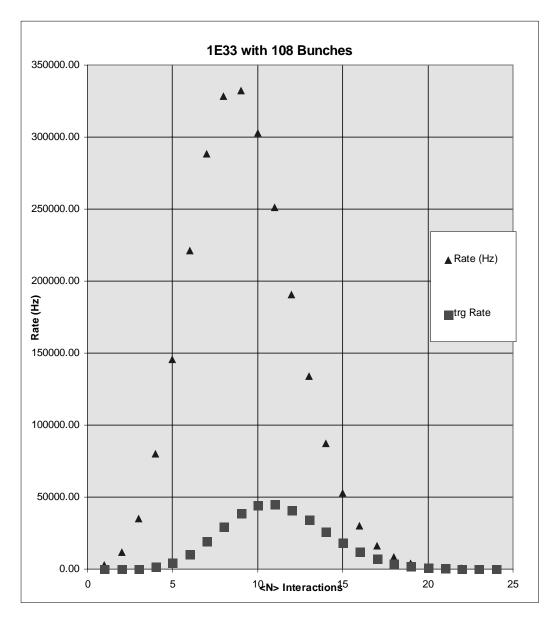
We have MC data for trigger rejection rates for 1 through 4 interactions. Extrapolate this to higher orders using some fitting function.

A 2nd order polynomial and a power function fit about equally well to any single series of data, but the polynomial is more consistent across all the fits.

Fit to Integrated Trigger Rate



MC data for trigger rejection rates for 1 through 4 interactions per crossing and fits to that data. Two different Pt thresholds were used. For each Pt threshold two different trigger algorithms were used.



When we use the fit to the MC data to extrapolate to n interactions per crossing we can plot the trigger rate for any luminosity and number of crossings.

Here we plot to the 10 GeV fine binned trigger for 1E33 with 108 bunches.

cross	ings		
Luminosity	36	108	252
8.00E+31	17,442	2,175	577
2.00E+32	119,544	14,332	10,560
1.00E+33	560,509	341,681	59,040
2.00E+33		1.365.701	249.302

This table has the Trigger rate in Hz for a 10 GeV threshold fine bin trigger for different luminosities and numbers of beam crossings.

What is an OK rate?

D0β Level 1 accept rate is about 10 kHz

A stand alone charged track trigger < this could be used The CFT Trigger will be combined with CPS/CAL/or MUON for major level 1 triggers - These give extra rejection.

For up to about 8E31 and 36 bunches and 2E32 and 108 bunches the trigger rate should be OK.

For 1E33 even with 252 bunches the rate is BAD.

What to Change

Need to lower Occupancy

Segment in eta

Space - cutting fibers at Z=0 would give a factor of 2 reduction. Any more segmentation would result in more clear fiber guides (mass) in the tracking volume.

Time - Need sub nsec timing. Hard to do, impossible(?) to get in <100 nsec.

Finer Segments in r phi

Now have 10-20 pe per MIP - could only reduce to ½ or ¼ of this at most.

Need better fake rejection

Incorporate U/V fibers - this is under intense studies at D0 β . This is very I/O intensive.

Finer Segmentation in r phi - could try to use the minimum bin size for binning. This is hardware intensive.

Add Pad Layers - this is also under study for D0 β and is being presented at the tracking session.

Increase Trigger Bandwidth

Reject them off-line - there are lots of benefits of increased bandwidth <u>if</u> it is used for real physics and not fakes.

Have Fewer Events per Crossing

Problems a function of <N> not L - This is a definite plus for the fiber Tracker since it has a fast response time. This does not work for all the detector elements.

crossin	ngs		
Luminosity	36	108	252
8.00E+31	1,090	136	36
2.00E+32	7,471	896	660
1.00E+33	35,032	21,355	3,690
2.00E+33		85,356	15,581

This is a what if table of rates segment fibers in +-Z
½ the fiber pitch
use the minimum bin size
use pads
and we get an estimated reduction of 16 overall

We are alive at 1E33 but need more bunches at 2E33.

Summary

Occupancy is most important factor in CFT Trigger performance.

Must do many different things to lower occupancy.

The enemy is the number of events per crossing.

Next generation CFT has many more channels and more complex trigger.